

WEATHER AND CIRCULATION OF DECEMBER 1972

Record Cold in the West

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1. MEAN CIRCULATION

Two strong blocking ridges, one located near Alaska and the other over Europe, were primary features of the mean 700-mb circulation for December 1972 (figs. 1, 2). These ridges were separated by a mean trough that extended across the North Pole from northern Asia into the Atlantic Ocean, giving rise to a basically simple two-wave configuration in the mean circulation at higher latitudes. This basic pattern represented a significant change from the mean circulation of November 1972 (Dickson 1973), resulting in large month to month anomalous height changes over the region (fig. 3).

Southern extensions of the polar trough included mean troughs along the Asiatic coast, over North America from Hudson Bay to Mexico, and in the region of the Caspian Sea. Elsewhere, a broad ridge exerted its influence over the eastern United States and across the southern part of the Atlantic Ocean. A flat ridge was observed over the western Pacific Ocean with a more amplified ridge near the west coast of North America, while a well-developed trough stretched northward from the Hawaiian Islands. A weak trough was associated with a mean Low over the Mediterranean Sea, while a ridge predominated in central Asia.

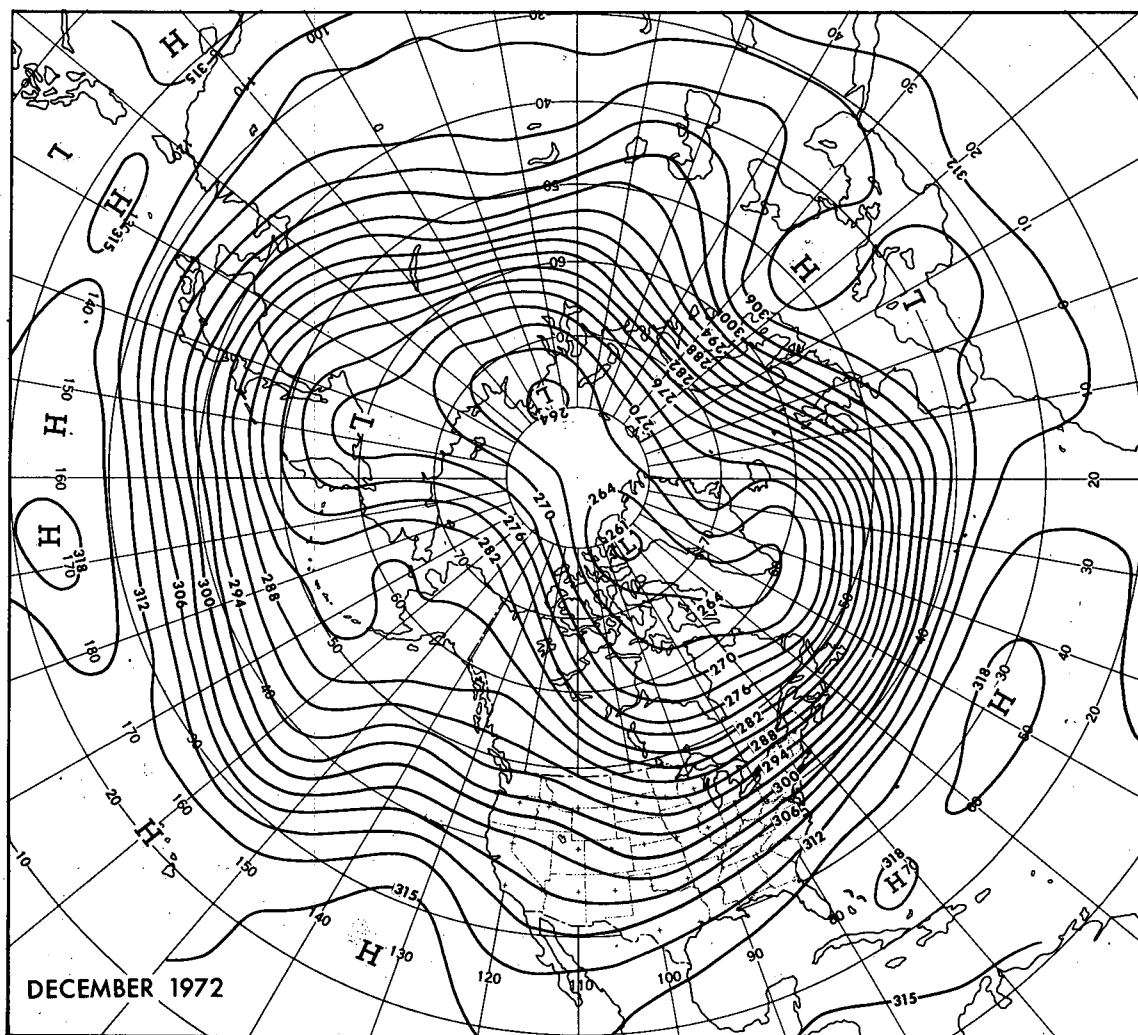


FIGURE 1.—Mean 700-mb contours in dekameters (dam) for December 1972

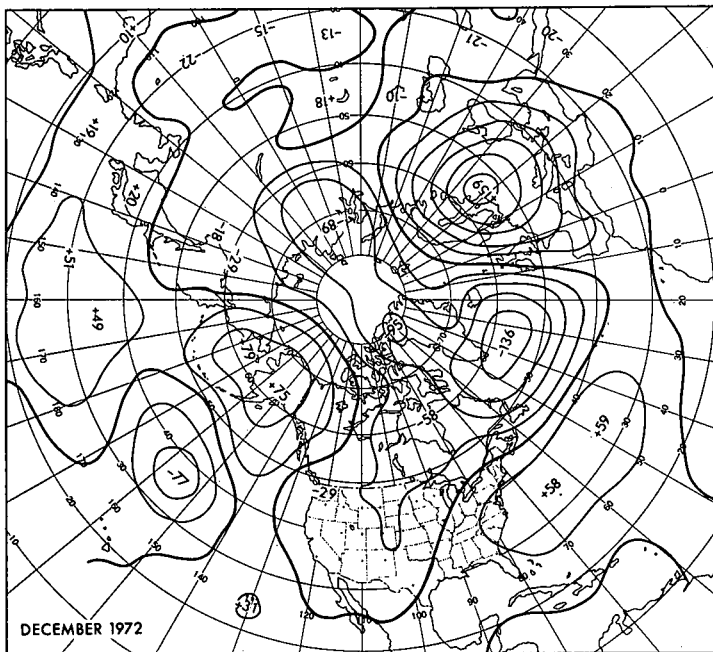


FIGURE 2.—Departure from normal of mean 700-mb height in meters (m) for December 1972.

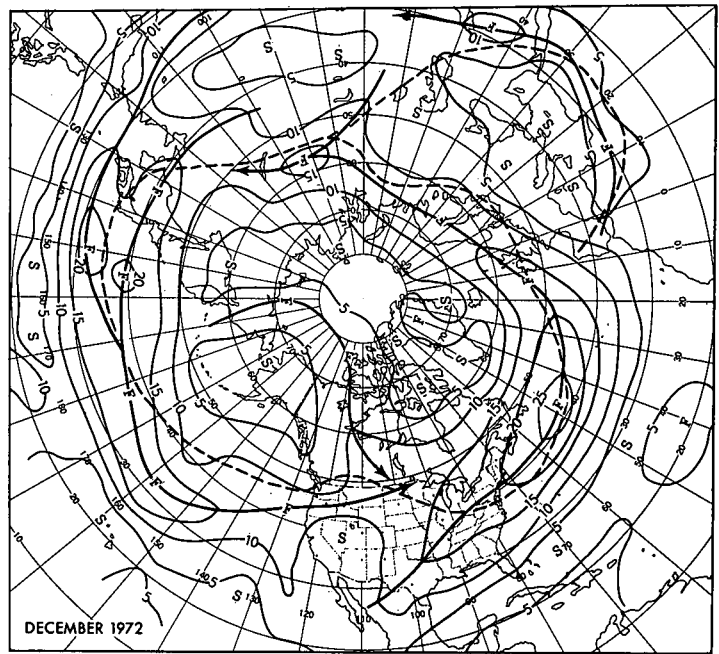


FIGURE 4.—Mean 700-mb geostrophic wind speed (m/s) for December 1972. Solid arrows show the observed axes of maximum wind speed, and dashed lines show the normal.

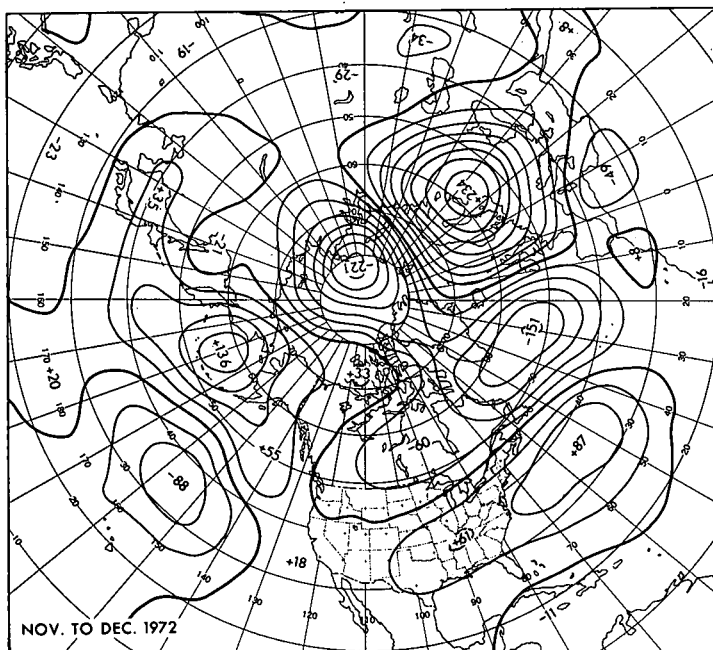


FIGURE 3.—Mean 700-mb height anomaly change (m) from November to December 1972.

Midlatitude zonal westerlies were strongest across the Atlantic Ocean during December 1972 (figs. 1, 4). Mean 700-mb winds averaged more than 5 m/s faster than normal from eastern North America to Europe. Maximum wind speed, in both an actual and an anomalous sense, was reached southeast of Newfoundland where the winds averaged about 27 m/s, more than 11 m/s above the normal. In the Pacific, the axis of strongest westerlies was south of normal from mid-ocean to the United States in response to the effects of the Alaskan block.

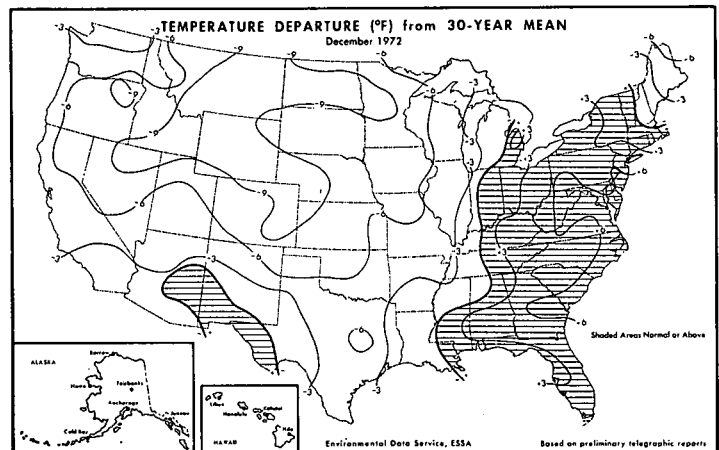


FIGURE 5.—Departure from normal of average surface temperature (°F) for December 1972 (from Environmental Data Service and Statistical Reporting Service 1973).

2. TEMPERATURE

Mean monthly temperatures in the United States for December 1972 were mostly below normal over the western two-thirds of the Nation with above normal temperatures predominating in the East, except in northern New England (fig. 5). This pattern of temperature departures was in good agreement with the mean circulation, and showed a striking resemblance to the mean 700-mb height anomaly field (fig. 2).

Mean monthly station temperatures were the lowest ever recorded during any December at such diverse locations as Reno, Nev. (24.9°F), Milford, Utah (15.8°F), Goodland, Kans. (21.2°F), and Medford, Oreg. (31.5°F). Many more low mean temperature records would have been established in the West had not strong warming

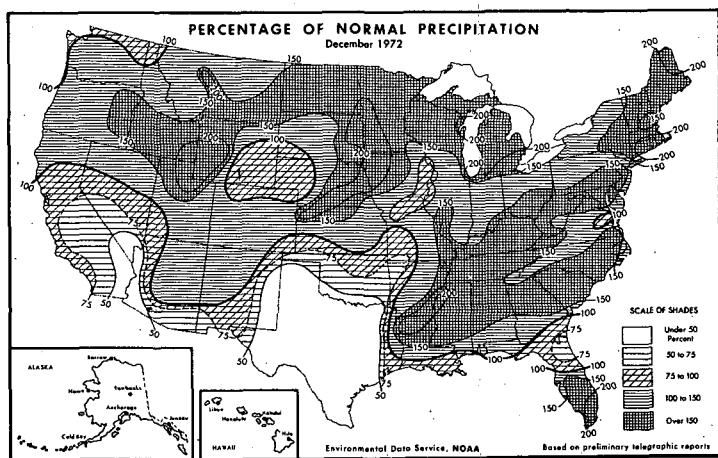


FIGURE 6.—Percentage of normal precipitation for December 1972 (from Environmental Data Service and Statistical Reporting Service 1973).

TABLE 1.—Daily temperature records established during December 1972

Station	Date	Temperature (°F)	Remarks
Yakima, Wash.	1	67	Highest observed in Dec.
Corpus Christie, Tex.	5	90	Do.
Clayton, N. Mex.	6	-6	Lowest observed in Dec.
Eugene, Oreg.	8	-12	Lowest observed all-time.
Salem, Oreg.	8	-12	Do.
Yakima, Wash.	8	6	Do.
Sexton Summit, Oreg.	8	2	Lowest observed in Dec.
Tampa, Fla.	8	86	Highest observed in Dec.
Burns, Oreg.	9	-26	Equaled lowest obs. all-time
Blue Canyon, Calif.	9	3	Lowest observed in Dec.
Reno, Nev.	9	-16	Do.
Eureka, Calif.	9	21	Lowest observed all-time
Milford, Utah	10	-32	Do.
Boise, Idaho	10	-23	Do.
Ely, Nev.	10	-28	Do.
Do.	10	-4	Lowest observed max. all-time
Denver, Colo.	10	-18	Lowest observed in Dec.
Pocatello, Idaho	10	-28	Do.
Pendleton, Oreg.	10	-13	Do.
Charleston, S.C.	11	83	Highest observed in Dec.

taken place over the Nation during the last half of the month.

Numerous daily minimum temperature records were also broken during the period as cold arctic air inundated the West during the first half of December. In addition, some stations reported the lowest daily minima not only for December but for any month (table 1). December 10, for example, was the coldest day in the history of Ely, Nev., where both the maximum and minimum temperatures were all-time record lows.

3. PRECIPITATION

Total precipitation during December 1972 was near or above normal over much of the United States (fig. 6) in response to storminess associated with the mean 700-mb trough over the middle of the Nation (fig. 1). However, stronger than normal mean northwesterly flow helped to keep a portion of the Southwest relatively dry. Precipita-

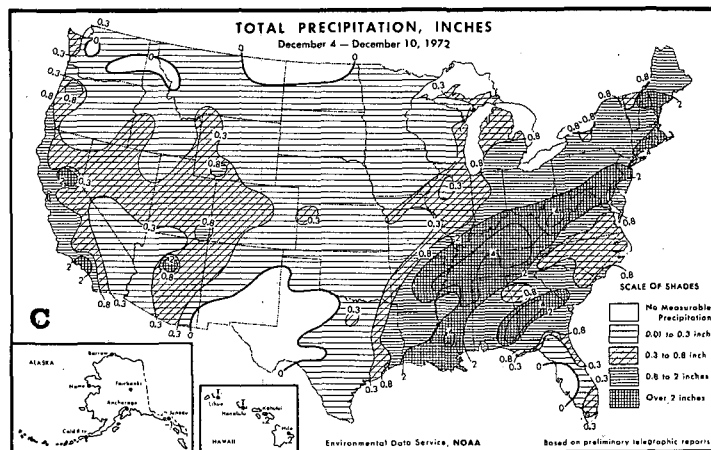
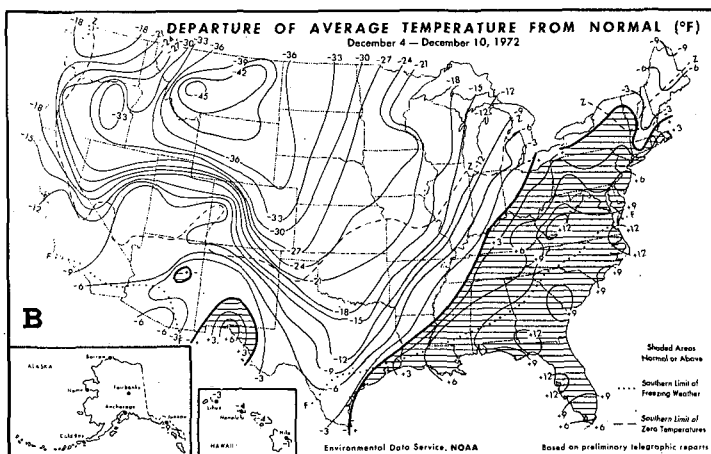
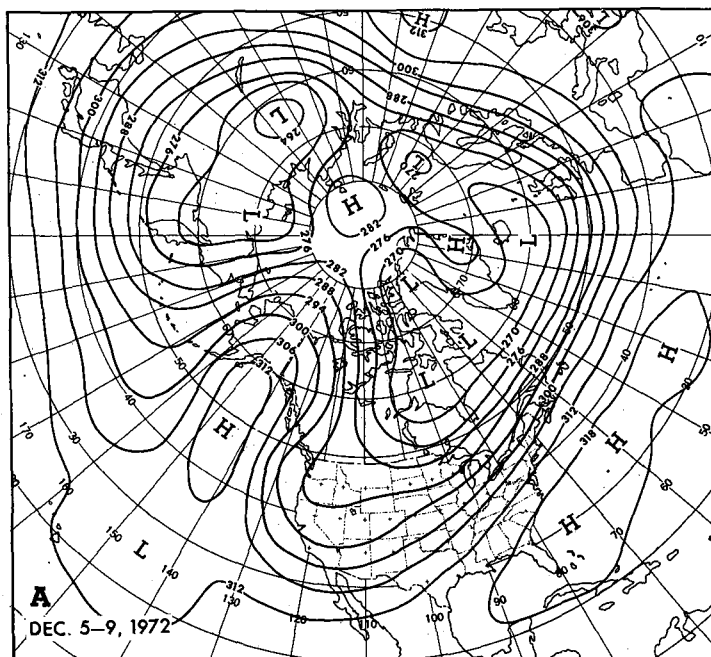


FIGURE 7.—(A) mean 700-mb contours (dam) for Dec. 5-9, 1972; (B) departure from normal of average surface temperature (°F) and (C) total precipitation (in.) for week of Dec. 4-10, 1972 (from Environmental Data Service and Statistical Reporting Service 1972).

tion was also below normal in the Southern Plains, as fast westerlies crossing the southern Rocky Mountains produced a rain shadow in that area.

The combination of confluent mean flow and an increased southerly wind component brought record December precipitation totals to Macon, Ga. (10.39 in.), Caribou, Maine (5.28 in. including a record December snowfall total of 59.9 in.), and Bridgeport, Conn. (7.87 in.). Record December cloudiness was reported by several stations in the Northeast. In addition, Boston, Mass., and Hartford, Conn., both registered a record number of December days having measurable precipitation. Record December snowfall totals were also observed at Lander, Wyo. (27.2 in.) and Milford, Utah, where the 30.6 in. of snow was the greatest amount at that station for any month.

4. WEEKLY VARIABILITY

The 700-mb circulation during the first full week of December was characterized by a highly amplified flow pattern from the Pacific Ocean into North America (fig. 7A). A strong blocking ridge was located in the Gulf of Alaska while a deep trough was observed over western United States. This pattern was essentially a continuation of the circulation regime that had begun to develop during the last week of November (Dickson 1973). The circulation around the rest of the hemisphere was generally zonal with fast westerly flow and long wavelengths as the predominant features.

The circulation during the second week (fig. 8A) was different from that of the previous week. Wavelengths were generally much shorter than they had been the week before as varying degrees of amplification around the Hemisphere brought more meridional flow to many areas.

Cyclonic deepening around Kamchatka helped to retrograde the blocking ridge from the Gulf of Alaska into the Bering Sea. As the ridge moved westward, northwesterly winds to the east transported arctic air with cyclonic vorticity over the relatively warm water of the Gulf of Alaska, leading to the development of a mean trough over the eastern Pacific. Formation of this trough was augmented by short-wave cyclonic activity that moved eastward, south of the retrograding block, into a partially cutoff Low near 40°N, 150°W.

The mean trough over North America weakened and moved eastward, and ridges formed near both the east and west coasts. A deep trough dominated the circulation over the central Atlantic Ocean, and a sharp ridge emerged over Europe. A trough developed in the Caspian Sea region as the pre-existing ridge moved into central Asia.

Changes in the circulation were less drastic from the second to the third week of December. A strong Gulf of Alaska Low was established by the Dec. 19–23 period, and the Pacific blocking had moved northward to Siberia (fig. 9A). The circulation over North America consisted of a ridge in the west with a trough in the east. Cyclonic activity increased across the pole from northern Asia to the Davis Strait, while mean 700-mb heights rose sharply south of Greenland. Although most other com-

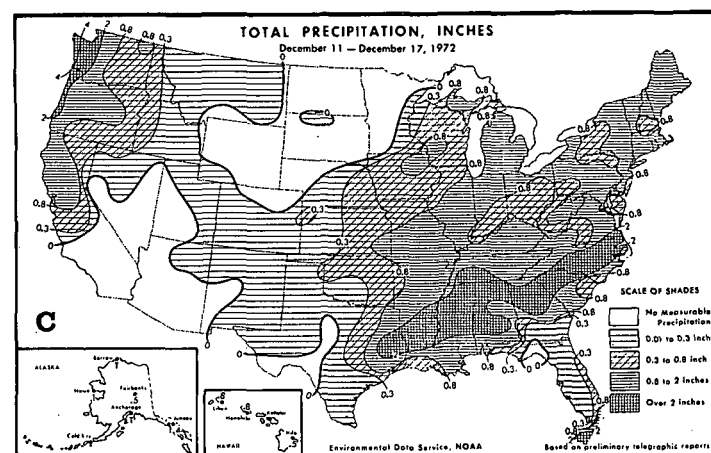
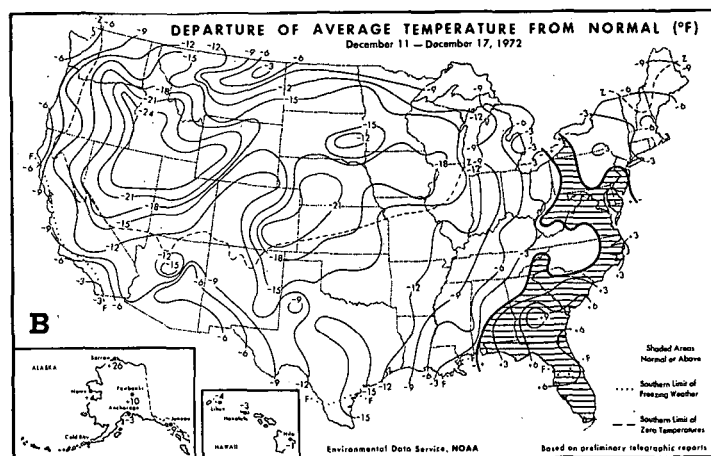
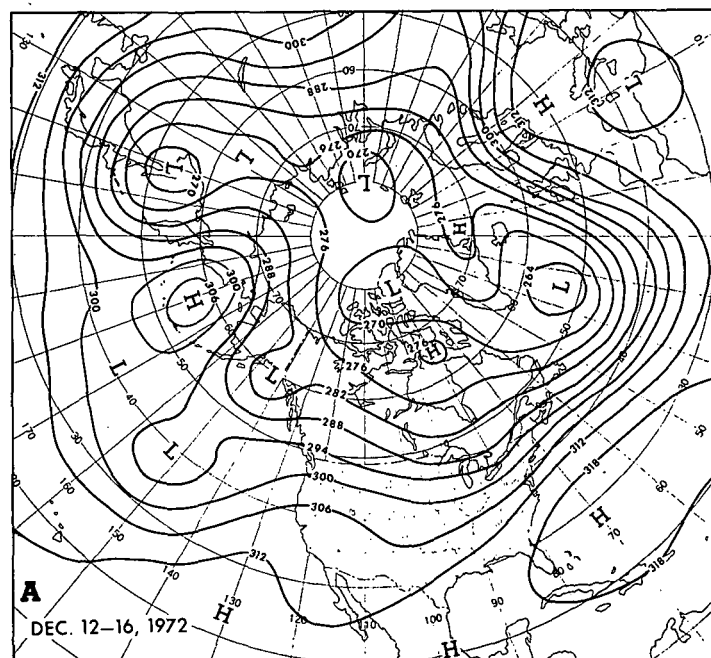


FIGURE 8.—Same as figure 7, (A) for Dec. 12–16, 1972; (B) and (C) for week of Dec. 11–17, 1972.

ponents of the circulation moved westward from their positions of the prior week, there was generally little change in the amplitude of most systems.

Near the end of December, an omega type of blocking regime was present over Europe. Downstream as far as

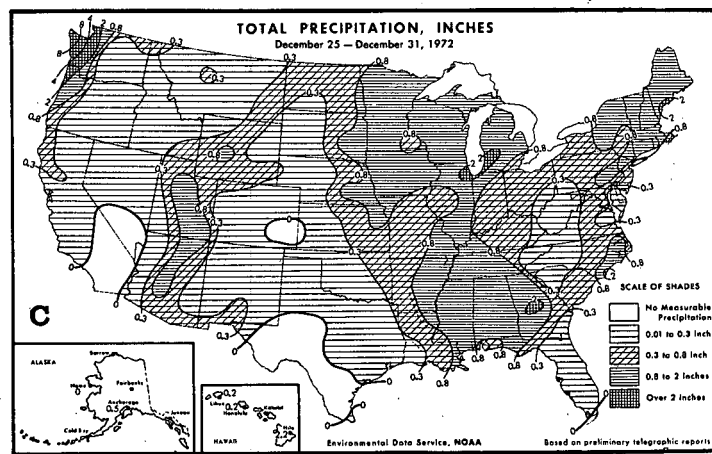
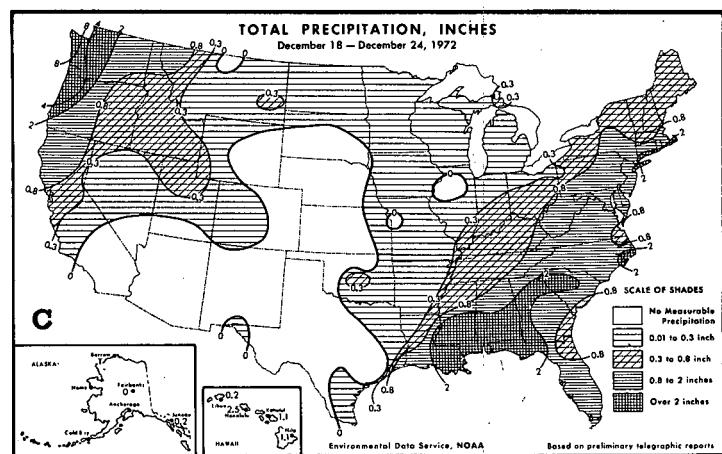
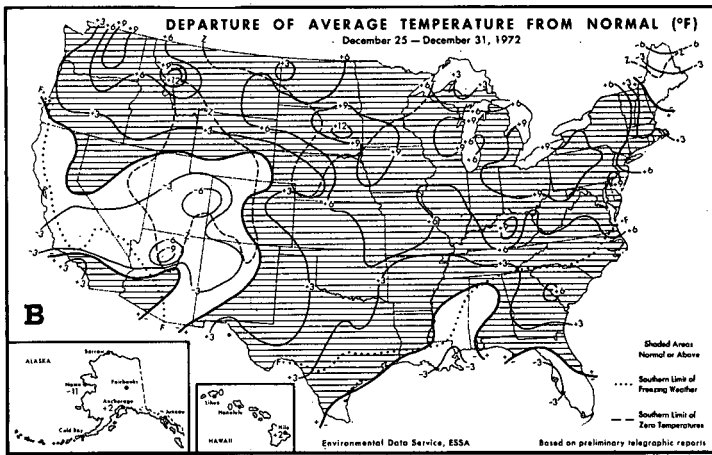
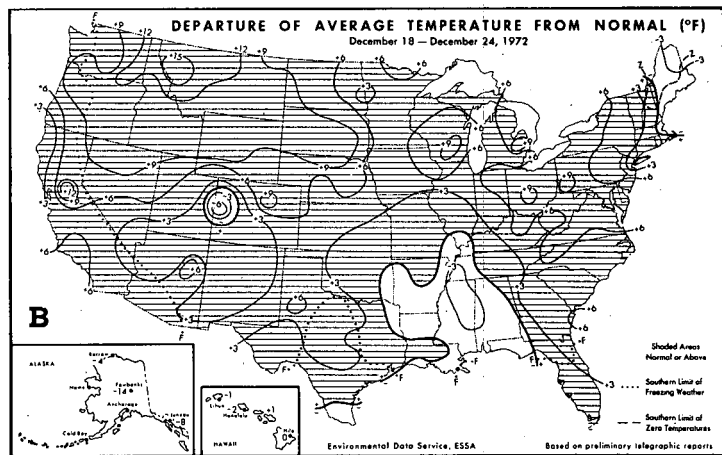
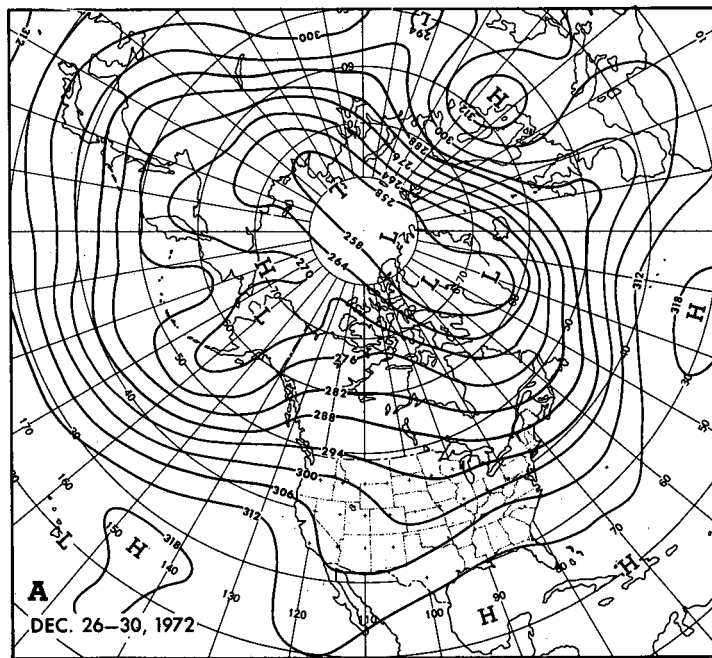
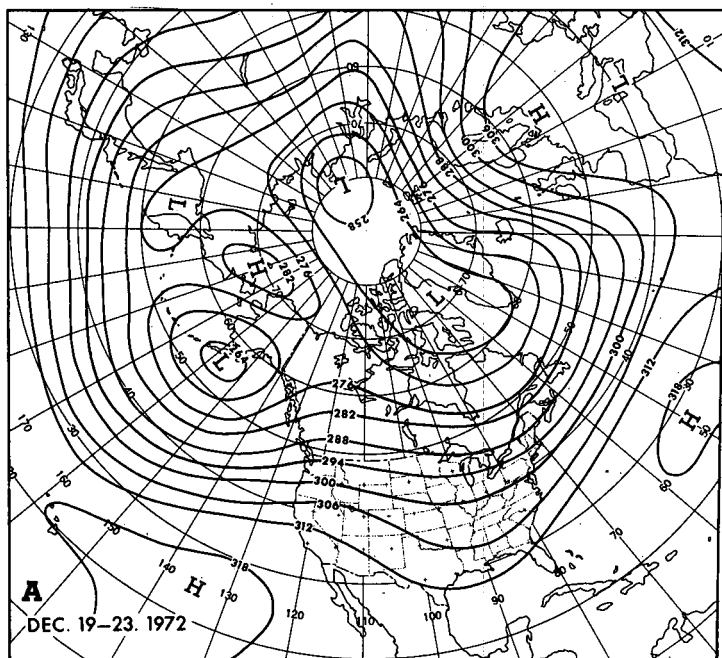


FIGURE 9.—Same as figure 7, (A) for Dec. 19-23, 1972; (B) and (C) for week of Dec. 18-24, 1972.

FIGURE 10.—Same as figure 7, (A) for Dec. 26-30, 1972; (B) and (C) for week of Dec. 25-31, 1972.

the west coast of North America, major components of the wave train retrograded at middle and lower latitudes (fig. 10A). A trough was again located over the southwestern United States, while a ridge prevailed over the East.

The mean temperature regime for December (fig. 5) was established early in the month. Record breaking cold arctic air covered much of the West during the week of Dec. 4-10 (fig. 7B) in response to strong northerly winds between the deep 700-mb trough over Hudson Bay and

the blocking ridge in the Gulf of Alaska. Meanwhile, temperatures were well above normal in the East as warm southwesterly winds prevailed over that area.

The well-entrenched cold air had moved both eastward and southward by the next week, giving below-normal temperatures to most of the country (fig. 8B). Although the intensity of the cold had begun to moderate somewhat, it was still very cold in the West.

By the week of Dec. 18-24, however, the effects of the developing Low in the Gulf of Alaska, combined with the ridging over the Rocky Mountains, brought strong warming to much of the Nation (fig. 9B). Mean weekly temperatures rose by more than 30°F in parts of the Rocky Mountain region. The above-normal temperatures remained over most of the country during the last week of December (fig. 10B), but cooler air was reintroduced in the Southwest in connection with the mean trough over the area.

Weekly precipitation patterns throughout December were generally similar in appearance with heaviest amounts occurring along the northwest coast and in the East (figs. 7C, 8C, 9C, 10C). Although precipitation in

the Northwest was relatively light during the first week as mean 700-mb winds paralleled the coastline, more than 4 in. of rain fell during each of the next 3 weeks in response to mean onshore flow.

In the East, the area of heaviest precipitation moved southeastward during the first 3 weeks as the mean trough advanced eastward across the country. By the fourth week, however, precipitation diminished throughout the East in association with a mean ridge over the region. Large parts of the Southwest and the Great Plains received no measurable precipitation during the middle two weeks of December as mean northwesterly 700-mb flow inhibited precipitation development.

REFERENCES

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- Dickson, Robert R., "Weather and Circulation of November 1972—Another Cold, Wet Month," *Monthly Weather Review*, Vol. 101, No. 2, Feb. 1973, pp. 182-186.